MACHINES FOR WORKING AND POLISHING MARBLE.*

LARGE slabs of marble and stone are ground very accurately in a machine patented by Mr. Tulloch, and called a grinding bed. In this machine, represented in fig. 9, the slab to be ground is placed horizontally upon a moving bed, and the grinding is effected by sand and water, by means of a large flat plate of iron resting upon the surface of the slab. The two surfaces are traversed over each other with a compound motion, partly eccentric and partly rectilinear, so as continually to change their relative positions. The machine consists of a frame about 9 feet long, 6 feet wide, and 8 feet high: about 2 feet from the ground is mounted a platform that is very slowly reciprocated horizontally for a distance of from 1 to 2 feet, according to the size of the slab, by means of a rack and pinion placed beneath, and worked alternately in both directions.

FIG. 9.

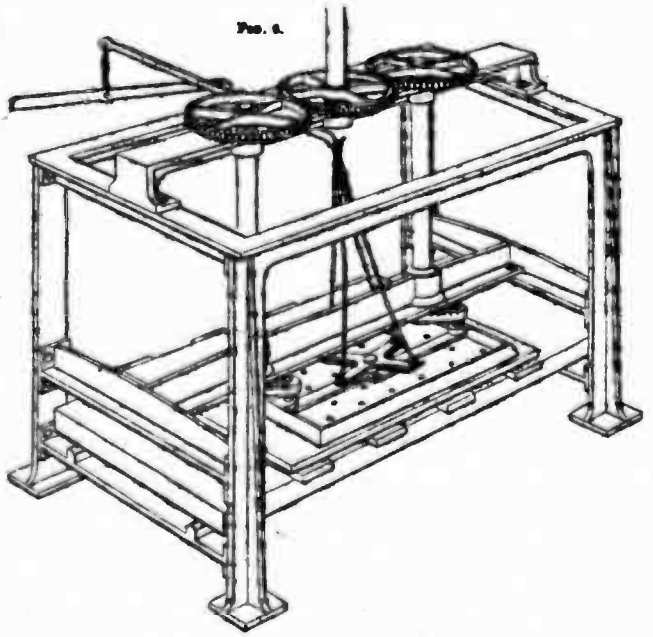


FIG. 10. FIG. 11. FIG. 12.

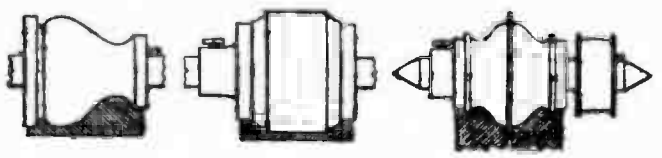
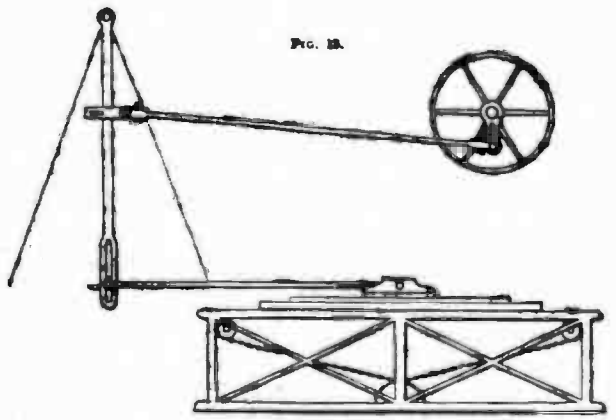


FIG. 13.



Above the platform are fixed vertically two revolving shafts, having at their upper extremities horizontal toothed wheels of equal diameter which are driven by means of a central toothed wheel keyed on the driving shaft. The two vertical shafts are thus made to revolve at equal velocity or turn for turn, and to their lower ends are attached two equal cranks placed parallel to each other, the extremities of which therefore describe equal circles in the same direction. To these cranks the iron grinding plate or runner is connected by pivots fitting two sockets placed upon the central line of the plate. The cranks are made with radial grooves, so that the pivots can be fixed by wedges at any distance from the centre of the cranks. When the machine is put in motion the grinding plate is thus swung round bodily in a horizontal circle of the same diameter as the throw of the cranks, which is usually about 12 inches, and consequently every portion of the surface of the grinding plate would describe a circle upon the surface of the slab being ground if the latter were stationary. But by the slow rectilinear movement of the platform the slab is continually shifted beneath the plate so as to place the circles, or rather the cycloids, in a different position, and it is only after many revolutions of the cranks that the same points of the surfaces of the grinding plate and slab are a second time brought in contact.

The grinding plate is raised for the admission of the slab by means of four chains suspended from a double lever, and attached to the arms of a cross secured to the centre of the upper surface of the plate, which is thus lifted almost like a scale pan. For slabs that are much thicker or thinner than usual, the principal adjustment is obtained by the removal or addition of separate beds, or loose boards, laid upon the platform to support the slab at the proper height. Slabs that are too large to be ground over the whole surface at the one operation, are shifted once or twice during the grinding, to expose the surface equally to the action of the grinding plate.

The necessary pressure for grinding is given by the weight of the horizontal plate, which is supported almost entirely by the work, as the pivots of the cranks merely enter the sockets, and allow the plate to descend when left to itself. For delicate works a counterpoise weight is attached to the double lever, so as to regulate the pressure on the work.

The sand and water are applied to the grinding surfaces in much the same manner as in the iron runners used by hand previously described. The grinding plate is made on the upper side with a raised rim like a tray, and the bottom of the tray is perforated with numerous holes about 1¼ inch diameter, arranged at equal distances apart. The sand and water are thrown into the tray at intervals in small quantities, and run through the holes and between the surfaces of the slab and grinding plate, which are thus uniformly supplied with the feed that ultimately makes its escape round the edges of the grinding plate.

Various qualities of sand may be employed according to the perfection of surface required, and very flat surfaces are produced by this machine. The grounding or smoothing of the best works is effected with a succession of fine emeries, with which the surfaces may be made very smooth, and almost polished; but from motives of economy, the grounding of ordinary works is more frequently completed by hand, with grit stones and snake stone before the work is finally polished on another machine.

Rectilinear mouldings in marble are wrought by machinery in a manner altogether different from the hand process of working mouldings, in which, as previously described, nearly the whole of the material is removed with chipping chisels, and the surfaces of the mouldings are only smoothed by abrasion. In the machine process, on the contrary, the whole of the material is removed with revolving grinders, by which the work is reduced to the required form, and left smooth at the one operation.

The machine for working rectilinear moulding, or as it is called *the moulding bed*, closely resembles in its construction a ripping bed already described, except that the frame carrying the revolving grinders is provided with the power of vertical adjustment by a screw placed beneath, in order to raise the grinder to the proper height to suit the thickness of the marble, and that instead of the grinders being thin circular sheets of iron, they consist of solid cylinders of cast iron turned to the counterpart forms of the required mouldings. Indeed, the ordinary ripping bed is occasionally used for working mouldings on large works, and when it is provided with the vertical adjustment for elevating or depressing the saw to any required position, the ripping bed is equally suitable for working mouldings; but as the latter are in general only required on slips of marble only a few inches wide, a narrow machine is usually employed for the purpose.

The forms of some of the grinders are shown in figs. 10, 11, and 12: the outline represents the grinder, and the shaded part beneath, the entire compound moulding that would be produced by the same. A separate grinder is required for every different moulding, and consequently a large number of grinders have to be provided to meet the demand for variety. They are all pierced with a central hole fitted to the axis of the machine into which they are

* Condensed from p. 303. From Holtzapffel's "Turning and Mechanical Manipulation."

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